Approaches to ISIM Procurement

R.Burg/J.Mather

18 Febuary 1998

Quarterly Review

QUESTIONS

- Who should manage ISIM?
- How tightly to couple organizations and hardware?
- Who integrates the parts?
- How to ensure compatibility of partnership contributions ?
  - Partners have separate budgets, schedules, needs
  - Negotiation required, may be problem
  - What happens if there’s a technical or schedule problem?
- Are approaches compatible with speed and cost control?

CONTEXT

- Open for new ideas - concepts not clear, may change with time
- Weight, volume, cost constraints favor fully integrated design
- Need good system design to establish interfaces among
  - instruments
  - spacecraft
  - ground systems
  - organizations
- Single Prime model for spacecraft with performance based contract

REQUIREMENTS

- Synchronize with Spacecraft, SWG process
- Synchronize with ESA, Canada, other partners
- Competitive process - HQ NRA
- Low Cost - break HST cost paradigm
- High Performance
  - Instruments have high benefit per unit cost

Common Resources

- Structural materials and structural model
- Thermal design, heat budget (detector dissipation limits size and readout rate)
- Mechanisms
- Optical components (mirrors, filters, …)
- Detectors and electronics
- Computers
- Instrument control and operations

OTHER SYSTEMS INSIDE ISIM

- **Fine guidance sensors**
- **Fast steering mirror**
- **Deformable mirror**
- **M3 mirror**

The ISIM can be fully integrated and still support partnering

- **Is this True?**
- **We want to maximize**
  - **degree of participation of partner**
  - **value received from partner**
  - **scientific return**
  - **advantage of broad international partnership**
- **The ISIM can be partitioned if there is an Integrated design, coordination during construction and Team integration**

POSSIBLE ISIM MANAGERS

- GSFC NGST Project Office
  - Responsible for coordination of all organizations and all interfaces
  - ESA, Canada, etc. to provide representatives to managment team
- Spacecraft Prime Contractor
  - Partner contributions must be predefined
  - Contractor to work directly with instrument teams
- Instrument Team (if proposed as an integrated set)
  - Team Leader selected with proposed organization plan
  - Team Leader reports to GSFC Project Office

Process 1 - Individual Instruments (HST, AXAF, etc.)

- Traditionally managed by government but could be modified to be managed by systems contractor
- Interface between observatory and ISIM must be specified in ICD if ISIM organization is different from systems contractor
- One PI/PM team per SI at the PI's institution
- Funds passed from managing organization to PI's institution and then to possible subcontractors
- Relationship to observatory and other instruments through Interface Control Documents
- Instrument control, calibration file formats, organization of team all, in general, are done very individually

Process 2 - Individual Instruments/Single Organization (Evolved HST)

- Strong managing organization (in case of HST Goddard) which takes strong technical responsibility for interfaces and operation coordination
- Interface between observatory and ISIM must be specified in ICD if ISIM organization is different from systems contractor
- Funds flow directly to build organization which is not necessarily the PI institution
- One organization to build (optional or key feature?)
- PI acts as adviser to help guarantee scientific accountability
- Each instrument is modular and individually competed for and designed - with common build organization instruments tend to share subsystem designs and components

Process 3 - Integrated Architecture/Modular Instruments

- Interface between observatory and ISIM must be specified in ICD if ISIM organization is different from systems contractor
- Joint science team with identifiable instrument leads
- Set up a joint co-located team in phase B and keep them together throughout the project
  - Instrument Manager (NASA?)
  - Instrument Scientist (ESA?)
  - System/design team (NASA/ESA/Canada)
- Preliminary design of ISIM done together
- Instruments fully identified
  - Detail design done independently
  - Critical parts from common agreed upon suppliers (eg.; Detectors, Computers, Mechanisms, Optics)
  - Construction done independently
  - initial integration with surrogate ISIM independently
  - Integrated team manages this process
- Final integration into ISIM module done together under control of integrated team
- Deliver ISIM to systems contractor for integration

Process 4 - Integrated Architecture and Instruments with Partners

- Set up a joint co-located team in phase B and keep them together throughout the project
  - Instrument Manager (NASA?)
  - Instrument Scientist (ESA?)
  - System/design team (NASA/ESA/Canada)
- Interface between observatory and ISIM must be specified in ICD if ISIM organization is different from systems contractor
- Joint science team with identifiable instrument leads
- Preliminary design of ISIM done together
- Detailed design done together
- Construction done by technical groupings
  - ESA Optics, Thermal, and Mechanisms
  - NASA Detectors, Instrument Control and Structure
  - Canada MIR components
- Integration into instruments by the team

Process 5 - Fully Integrated

- One organization designs and builds the ISIM
- One PM for entire process through integration
- One PI for ISIM - team can include instrument leads
- Interface between observatory and ISIM must be specified in ICD if ISIM organization is different from systems contractor

Comparison of Potential Processes

Approach	PI/PM	Design	Fabrication/ instrument integration	Components	Integration with other instruments
1)Individual Instruments (original HST, AXAF)	1 per SI/1 per SI	1 per SI	individual	individual	none or at systems contractor
2)Individual Instruments/ Single organization (evolved HST)	1 per SI/1 for program	1 per SI	single organization or individual	Common components can be used	none or at systems contractor
3)Integrated Architecture/ Modular Instruments	1 for team/1 for team (leaders for each SI)	integrated design	instruments built individually and integrated into surrogate.	common components as needed by integrated design and optimization	Final instrument integration by team
4)Integrated Architecture and Instruments with Partners	1 for team/1 for team (leaders for each SI)	integrated design	subsystems done individually instrument integration as a team	common components as needed by integrated design and optimiza-tion	not needed
5)Fully Integrated	1 for team/1 for team (leaders for each SI)	integrated design	build and integration done in one place	common components as needed by integrated design and optimization	not needed

Pros and Cons

Approach	Pro	Con
1)Individual Instruments (original HST, AXAF)	low risk if individual instrument is not ready; low risk to common component failure high identity factor; PI adds science perspective	high cost; schedule control is distributed due to large number of PI/PM at same level; PI's institution may not have adequate experience and/or oversight capability
2)Individual Instruments/Single organization (evolved HST)	pros similar to 1 with tighter schedule/cost control due to centralized control and build	more risk to common components/common design flaw. How do you integrate partners if fully single organization?
3)Integrated Architecture/ Modular Instruments	potential cost savings and high science return due to optimization; lower technical risk in areas such as thermal; instrument identified with partner	more risk to common components/common design flaw; must make international team work
4)Integrated Architecture and Instruments with Partners	potential cost savings and high science return due to optimization and common integration; technical strengths of partners optimized;	cons similar to 3 with addition of little individual identification.
5)Fully Integrated	potential cost savings and high science return due to optimization and common integration	cons similar to 4 with no utilization of international partners

Next Generation Space Telescope

Earth Imager

Option	Maximal NGST	Minimal NGST
Overview	1Km resolution (~2-m aperture); Image of › earth every 6 hours; At least 25,000X25000 pixels	1Km resolution (~2-m aperture); Image of › earth every 6 hours; At least 25,000X25000 pixels
Deployment	Deployable segemented primary (possibly unfilled)	Fixed primary
Band and detectors	0.5-5 micron InSb detectors	0.4-0.9 micron CCD detectors
Sunshield/ Baffles	Deployable sunshield–umbrella design to protect rear of primary and secondary. Baffles for stray light	Fixed Tube to suppress stray light
Thermal Design	NGST design to passively cool primary. Possible use of turbo-brayton cooler for INSB	Room Temperature design
Optical Control	Full NGST optical control system	Optional use of NGST system or body pointing
Mirror Technology	15 kg/m^2; one of NGST technologies	Traditional technology, SIRTF and NGST are all options

Next Generation Space Telescope